Identifying and Analyzing Moral Evaluation Frames in Climate Change Blog Discourse

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Abstract

Media frames define distinctive perspectives or ways of communicating about issues and can be manifested through patterns of language use, such as preferences for various key terms and phrases. In this work we develop a novel operationalization of moral evaluation frames and study their use within a corpus of blogs discussing climate change. We compare moral evaluation frames between blogs marked as climate change skeptics and climate change acceptors. We develop a text visualization tool called Lingoscope that allows the user to observe and filter the contextual terms that convey moral framing across large volumes of text, as well as to drill down to specific examples. By focusing on climate-related topics and how they are discussed by climate change skeptics versus climate change acceptors, our approach uncovers and explores how numerous topics are framed in a different moral light in skeptical and acceptor blogs.

Introduction

Framing refers to the ways in which an issue is presented in the media, including the various perspectives and conceptions that people communicate with respect to that issue. The way language is used around an issue can subtly or not-so-subtly influence the way we think about it. Are you "pro choice", or "pro life"? With the flip of a single word the abortion issue can be framed with values related to freedom of choice, or with respect to the value of human life – both moral propositions. These kinds of framing effects have implications for public perception and ultimately public opinion on issues of importance to society (Chong and Druckman 2007).

Framing manifests in written media through the choice and usage of words in conjunction with an issue including the presence or absence of key words, stock phrases, and stereotyped images. Words that are often collocated can prime each other: if a reader repeatedly sees the phrase "illegal immigrant" then they may be primed to think of "illegal" when they see "immigrant" due to frequent previous exposure (Baker 2010). Entman posits that there are different types of frames that correspond to the definition, causal interpretation, moral evaluation, and solution space of a problem (Entman 1993). Other ontologies of frames include notions of issue or institution involved, such as legal, economic, ethical, governmental / political, and scientific (Baumer et al. 2013). In this work we focus on the operationalization and study of one particular type of frame: moral evaluation. Understanding the moral judgments manifest in media can provide insight into the value-propositions and beliefs around an issue, perhaps uncovering new avenues to address differences in values and find common ground around an issue.

We focus our study of moral evaluation frames on blogs discussing climate change issues. Climate change discourse is multifaceted and invokes diverse frames from science, politics, economics, and environmental issues. It is also a polarized discourse (Hoffman 2011) and thus well suited to our study of moral frames, since climate change acceptors and skeptics are likely to maintain contrasting moral evaluations on a range of sub-issues.

Building on previous methods which have used key term collocations to study framing (Baker 2010; Grundmann and Krishnamurthy 2010), here we develop a novel operationalization of moral evaluation frames based on dictionaries of virtue and vice terms that allows us to scale our analysis to millions of texts. We first identify and rank topical issues with salient and divergent moral frames. Then these frames are examined in detail using Lingoscope, a visual analytic tool we developed to enable us to analyze the frame of a topic (e.g. "sea ice"), filter context terms that show statistically significant differences, and drill into original texts to read how skeptics and acceptors frame the topic differently. We discuss examples of intriguing differences in moral frames between the two groups, and reflect on the limitations of our approach.

Identifying Moral Frames

Here we describe the corpus of climate change texts we gathered and analyzed, and detail the operationalization of moral evaluation frames that we developed.

Domain Corpus

Between June and September 2012, we crawled the content of about 3,000 English-language blogs (~1.5M posts) that included a mention of "climate change" or a related term. Five seed blogs were chosen by one co-author with domain

knowledge as both well-connected and representative of different viewpoints in the climate discourse. Related domain terms were manually identified from frequent n-grams on these seed blogs. A blog's posts were harvested if it was in English and had at least one of the key terms on its homepage. The crawl followed links from the homepage of each blog: if the next blog visited did not match our topic criteria, the crawl went only one step further from its blog roll. The text used for subsequent analysis in this paper was extracted from each post using the Alchemy API (http://www.alchemyapi.com/).

Skeptics and Acceptors

Prior research has shown contrasts in how climate change skeptics and climate change acceptors talk about various issues related to climate change (Hoffman 2011). Thus we expect there to be manifest differences in the moral framings between these two ideological groups on at least some of the key topics in the climate change discourse.

In order to study these contrasts we manually classified a selection of blogs as either "accepting" the majority view on anthropogenic global warming, "skeptical" of this view, or "neutral". Some of the blogs noted a clear position in their titles or sub-titles and could be classified on that basis. For the rest of the blogs we: (1) found the posts on the blog tagged with "climate change" either via the blog's search function or by looking at its "About" page or for relevant tags among the blog's classification of topics, (2) from those posts inspected the sentences containing the word "climate" and its context, and (3) tried to identify statements that explicitly expressed the views of an "acceptor" or a "skeptic." If no endorsement of either position could be found, the blog was labeled as neutral.

We looked at multiple statements to ascertain the blog's class. We labeled a blog as "acceptor" if it either explicitly stated that climate change or global warming is caused by human activity or it expressed views on what should be done in the fight against climate change without actually mentioning its causes. For example, blogs that used phrases such as "climate change is the most serious threat facing humanity today" were classified as "acceptor". Blogs that rejected mainstream climate science en bloc were classified as "skeptic". Blogs that used terms like "warmist" or "alarmist" to characterize mainstream climate scientists or people arguing in favor of measures to mitigate climate change were also classified as "skeptic."

With this method we classified the entire blog on the basis of statements in a few blog posts, assuming that the blogger is consistent and does not change their mind. In a few cases the blog's policy was to represent both positions; these blogs were classified as "neutral".

One person did the initial coding which was then evaluated by having a second coder classify a random sample of 60 blogs. The agreement was 84.8% and the weighted Cohen's kappa 0.72, which is considered to be good. The disagreements concerned whether a handful of blogs should be classified as either neutral or acceptor. There were no cases where a blog was classified as "skeptic" by one coder and "acceptor" by the other.

Measuring Moral Evaluation Frames

Here we detail our procedure for operationalizing moral evaluation frames. We compute frames for topics drawn from an ontology of 133 key terms and phrases extracted from climate change discourse (Chang et al. 2005).[1]

We operationalize a frame around a topical term by constructing a vector describing the set of unigrams and their relative frequencies found in a context around that topical term. Possible contexts for frames might include looking immediately before or after a topical term, or in the same sentence or paragraph as that term. Here we focus on the context terms appearing in the same *sentence* as a topical term. Each dimension of the vector represents a unigram and describes the number of times that unigram appears in the same sentence as the topical term divided by the number of times that topical term occurs. In order to reduce noise in the context vector, we exclude context terms that occur less than 10 times around a topical term.

Moral evaluation frames are operationalized using dictionaries from the General Inquirer for *virtue* and *vice*.[2] Other more fine-grained dictionaries that capture different dimensions of morality could also be used.[3] Terms in the virtue dictionary represent "an assessment of moral approval or good fortune, especially from the perspective of middle-class society" and in the vice dictionary "an assessment of moral disapproval or misfortune". There are 719 virtue words and 685 vice words in total. We construct virtue and vice frames by filtering our context vectors as described above through each of these dictionaries respectively. Thus for each of the 133 topical terms we have four vectors, representing the relative frequency of words in the virtue and vice dictionaries for each of the skeptics and acceptors discourse communities.

Analysis of Moral Frames

Using the operationalization of moral evaluation frames described above we ask the questions: (1) are there some topics that are framed more virtuously by either skeptics or acceptors?, (2) how is the moral framing for a given topic different for blogs that are known skeptics versus acceptors?, and (3) are there specific context terms that are used substantially differently in the moral framings of topics within each community? To answer these questions we scored each topical term in various ways and then used these scores to identify "interesting" topics, which we then explore with the Lingoscope tool, described further below.

To help identify topics which show a difference in framing we rank topical terms based on an overall

[1] http://www.ecoresearch.net/climate/
[2] http://www.wjh.harvard.edu/~inquirer/
[3] http://harmony-institute.org/therippleeffect/2013/06/18/the-moral-color-of-network-television/

"goodness" score, G, equal to the difference in virtue (Vt) minus vice (Vc) vectors for acceptors and skeptics,

$$G = \sum_{i \in context} [Vt_i(a) - Vc_i(a)] - [Vt_i(s) - Vc_i(s)]$$

G captures the relative magnitude and frequency of use of virtuous terms in the context words around a topic (controlling for the use of vice terms), where a higher score indicates the topical term is framed as more morally "good" in the acceptor camp than the skeptic camp.

The top and bottom 10 terms as found using this ranking are shown in Table 1, and reflect what topics either discourse community finds morally "good". Some of these correspond to an intuitive notion of how one might expect climate change acceptors and skeptics to evaluate various topics. For instance, highly ranked terms such as "geothermal energy", "wind farm", "solar panel", "biofuel", and indeed "alternative energy sources" indicate that acceptors have a high moral evaluation of alternative energy options. A higher G-score can also reflect cases where acceptors use fewer vice terms than skeptics (i.e. "less bad"), such as with the terms "infectious disease", and "ocean acidification." On the other hand, low ranked terms (i.e. terms that skeptics rank as more morally good than acceptors) include topics such as "climate forcing" and "resource management".

In order to identify other terms that might be interesting candidates to examine in more detail we also computed the Jensen-Shannon (JS) divergence for the virtue vectors of skeptics and acceptors and the vice vectors of skeptics and acceptors. The JS divergence measures how much each pair of vectors deviates, with a score of one indicating the vectors are very different, and score of zero indicating no difference. Some of the topics that had high JS divergence for virtue vectors but which weren't ranked in the top or bottom based on the G-score include, "solar irradiance", "climate policy", "nao", "snow cover", "glacier", "climate adaptation", and "tropospheric ozone". Such topics indicate areas of the discourse where skeptics and acceptors use different types of virtue framings. For vice JS divergences, high scores were observed for terms such as "anthropogenic", "water vapor", "heavy rain", "famine", "health impact", and "wildfire". In the next section we provide additional detailed observations contrasting moral framings for some of the terms mentioned above.

Table 1. Topical terms ranked using the goodness score, G.

Top Ranked		Bottom Ranked	
Topic	**G**	**Topic**	**G**
geothermal energy	0.42	hydropower	-0.51
wind farm	0.32	insurance	-0.42
alternative energy sources	0.29	resource management	-0.31
carbon sequestration	0.23	coral bleaching	-0.27
quality of life	0.22	climate forcing	-0.24
solar panel	0.22	interglacial	-0.22
ocean acidification	0.18	capacity building	-0.19
biofuel	0.16	flood risk	-0.18
energy policy	0.15	enso	-0.18
infectious disease	0.14	sustainable development	-0.15

Visual Analytics of Frames

We developed an online visual analytic tool called Lingoscope that helps to identify and compare the frames around specific issue terms. The G-score and JS divergence help to identify potentially interesting frames to drill into more deeply with the Lingoscope. Shown in Figure 1, Lingoscope allows the user to select two sources (acceptors and skeptics in this case), choose a frame context (e.g. "sentence") and apply various filters to the context terms that are identified. In this work we use three filters in particular, the virtue and vice dictionaries as previously described, as well as a mathematical filter which applies a z-score test between the relative frequency of each individual context term. The z-score filter is useful for directing the analyst's attention as it highlights context terms whose frequencies of use are statistically different.

The Lingoscope shows a ranked list of the context terms that meet all of the filter criteria, comparing the relative frequency of use of that term for the given search term between skeptics and acceptors. We also show a small timeline for how the frequency of use has changed over time. Clicking on the bar chart allows the user to drill into and see snippets of the text where the terms were found. The user can click a link to see the entire blog post as well. The Lingoscope thus supports an analytic strategy that helps social scientists explore the frames of various search terms, identify interesting aspects of those frames using filters, and read the original context and any nuances of use of those terms in the texts.

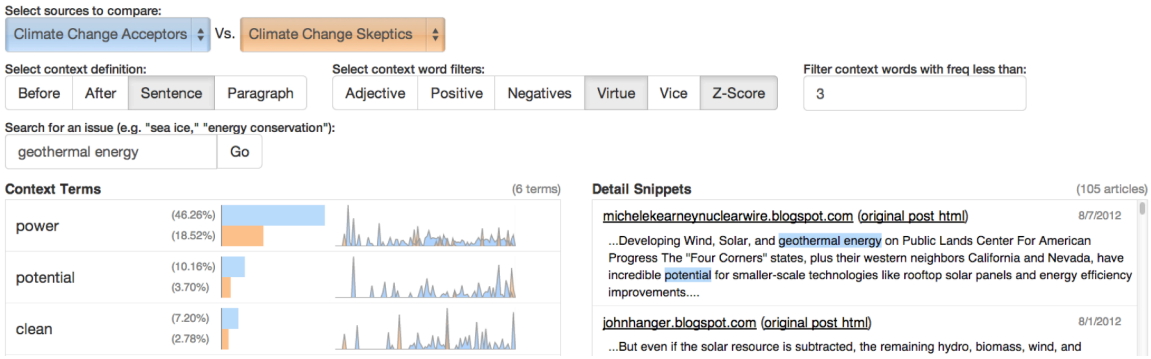

Figure 1. Lingoscope showing the comparison of virtue frames for the topic term with highest G-score: "geothermal energy."

We now examine the framings of several of the topical terms identified in the previous section using the Lingoscope. Consider "geothermal energy", the term with the highest G-score. The term has 1,083 hits in the acceptor blogs but only 108 in the skeptical blogs. The three most frequent virtue terms in the context of "geothermal energy" are "power", "potential", and "clean" (see Figure 1). We see that "power" is the context word with the largest number of hits both for skeptics and acceptors. This term is in the virtue dictionary but in these blog-texts it is not used in the moral sense but rather mostly as a synonym for physical energy. The term "clean" however is used by the acceptors in the moral framing of geothermal energy as a good energy source, and the term "potential" is often invoked to suggest the possibilities of geothermal energy. The skeptics use these words in the context of "geothermal energy" much less frequently.

Often the same terms that are used by the acceptors to frame some phenomena as morally good are also used by the skeptics in their criticism of the mainstream view on climate change. Examples of terms that are used in this way in various contexts – for example around "solar panel" and "wind farm" – are "clean", "efficient", and "expensive". Around the term "climate science" skeptics use words like "truth", "integrity", and "trust" which are virtue terms but which upon further examination reflect a critical stance toward the terms (i.e. questioning "integrity"), further supported by vice terms such as "bad" and "false" being used substantially more by skeptics. These results reinforce previous findings indicating that climate skeptics are often critical of the scientific evidence supporting global warming (Hoffman 2011). For a key phrase like "quality of life" (see Figure 2) both camps use a predominantly virtuous frame, though acceptors use even more virtue terms. Examining which context words are the focus of the virtuous frame is illustrative: skeptics use virtue terms like "prosperity" and "freedom" whereas acceptors use terms like "safety", "opportunity", and "culture". Although both sides find the term virtuous, they see it through different lenses.

Our use of the Lingoscope also underscored a limitation due to the loss of syntactic information when using a dictionary approach to operationalize frames. Consider "IPCC" for which Lingoscope identifies as significant the context terms "study", "use", "particular", "mean", "wrong", and "error" – only the last two terms really contribute to the moral framing of the IPCC. The context terms that seem to shed the most light on the moral framing are terms that have unambiguous evaluative interpretations. The word "mean" is a vice word, but is also often invoked in its mathematical sense when talking about climate temperature. Other frequent context terms that we found are mostly used in their non-moral sense are "power", "use", and "study". Moreover our approach does not capture negations of frame terms, so where for example skeptics use more vice terms for "ocean acidification", such as "damage" or "threat" they are being *critical* of these vice terms (i.e. that it is *not* a "threat"). This suggests that future work on automatically operationalizing frames must strive to account for the syntax of framing terms.

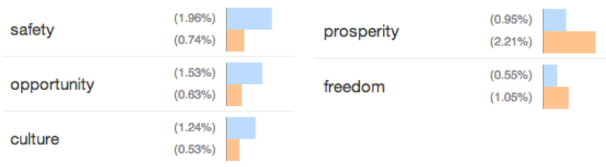

Figure 2. Differences ($p < 0.10$) in use of virtue terms around "quality of life" between acceptors (blue) and skeptics (orange).

Conclusions

In this paper we describe a novel operationalization to measure and facilitate the study of moral evaluation frames. We also present a visual analytic tool that enables the analysis and comparison of frames in use by skeptics and acceptors in climate change blog discourse. We identify several topical terms as salient and having different moral evaluation frames and show in detail how the frames for terms such as "climate science" and "quality of life" differ. We argue that although the lack of consideration of syntax introduces noise, our operationalization of moral evaluation frames provides a useful signal for identifying interesting cases to examine. Future work should develop syntax-aware methods, and strive to apply and evaluate our method to understand moral framing at scale within other issues (e.g. surveillance) or forms of text (e.g. comments).

Acknowledgements

We thank Knut Hofland and Lubos Steskal for their help in crawling blog data and the Research Council of Norway NTAP project for financial support.

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